



ASPECT PREDICTION OF THE KNITTED FABRICS FROM THE YARN PROPERTIES

Feliu Marsal¹, Daniel Palet¹, Liliana Indrie², Mariana Ratiu²

¹ Technological Innovation Centre CTF. Polytechnic University of Catalonia.
Terrassa, SPAIN, marsal@etp.upc.edu

² Faculty of Textiles and Leatherwork. University of Oradea.
Oradea, ROMANIA, lindrie@uoradea.ro, mratiu@uoradea.ro

Abstract: The textile technologist knows that the prediction of the aspect of a finished knitted fabric, by the parameters of yarn evenness, does not agree, often, with the reality. There are fabrics, in the market, with irregular aspect, made with yarns in which we have detected few faults. The conventional criteria that are considered in the evenness measuring equipments for the faults detection in the yarns are very limited.

In this paper a new evenness of mass index is proposed, denominated deviation rate DR, that, according to it is demonstrated in the experimental stage, it follows an excellent statistical correlation with the aspect of the knitted fabrics.

Keywords: Spinning. Unevenness. Knitting. Aspect prediction. Fabrics.

1. INTRODUCTION

An important problematic situation, for the knitters, is the prediction of the aspect that will offer the fabric. Nowadays the requirements of the clothing industry increases the problem. It is a difficult subject with a remarkably technical and economic interest. Moreover the claims and the charges, with return of clothes, are very expensive for the spinner.

With the measurement of the count yarn variability, the coefficient of variation of twist, the tensile strength and the elongation and your variability, the short period mass unevenness in the evenness meter and the appearance of the yarn in the tapered black board, we can deduce the behaviour in the knitting process and the possible aspect of the finished knitted fabric.

In a lot of cases this way is not near to the reality and, unlike which it was predicted, the spinner undergoes the consequences of the claims by the evenness of mass faults in the manufactured yarn.

The conventional criteria that are considered in the evenness measuring equipments for the count of the thin, thick and neps, they are not good related with the final aspect of the knitted fabric. Often it happens that some yarns, which have been detected few mass faults in the evenness meter, they originate knitted fabrics of secondary quality. The high difference between the results from by different types of evenness meters it can confuse to us in the evaluation of the results obtained.

The correlation between the conventional evenness parameters with the fabric aspect is low. The visual assessment of yarn appearance with the tapered black board is not related either with the aspect of the fabric, as they demonstrate in the last statistical studies carried out by prestigious research centres.

Furthermore, the criteria followed during the electronic clearing of the yarns are not coincident with the established in the evenness testing.

The knitted fabrics are much more sensible than those of woven at the variations of yarn mass. The gauge, the structure of the fabric and its color also has influence.

A new parameter, denominated deviation rate or DR, has been developed. The inclusion of the program of calculation of the DR in the microprocessors of the digital evenness meter Keisokki has facilitated the development of this new parameter. [1] [2] [3].

In this paper we studied the agreement with the aspect of the finished knitted fabric, in the sector of knitting yarns made by worsted spinning system.

In the figure 1 we indicated the DR, deviation rate, concept. The digital Keisokki equipment [4], for measurement of evenness of mass, has a microprocessor that determines the respective signals at Inert Test, central line M, the segments of intersection of the diagram that gives the variation of mass with established sensitivity and automatically calculates the index of mass deviation, DR.

A DR of the 40, for example, means that 40% of the analyzed meters are outside of established sensitivity. It is observed that the greater correlation with the aspect of the fabric is obtained working to a sensitivity of $\pm 5\%$ and with the reference length of 1,37 meters. The sensitivity as defined like the allowance in more and in less than we give at the value of the average mass M.

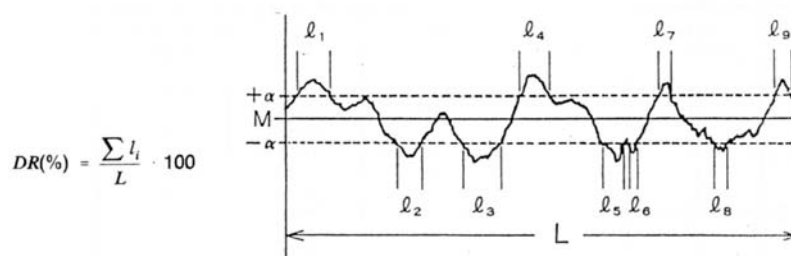


Figure 1: Deviation Rate, DR (%)

The considered length of yarn by to determine the instantaneous mass we defined as a reference length.

When taking a reference length of 0,01 meters, the yarn is tested at lengths next to the integrator (8 millimetres), for this reason the deviation rate, DR, will be evaluated with the same inertia that the integrator of evenness meter in a conventional analysis.

The Keisokki evenness meter provides the data of DR (+) and DR (-) considering, separately, the analyzed metres that are outside limits by excess and defect of mass. In some fabrics the mass excesses are more influential in their aspect than the mass defects, whereas in the fabrics with different texture can happen the opposite case.

Another important parameter to determine, is the value of sensitivity in which DR becomes zero, that is for that sensitivity in which all the variation of yarn mass, in more and less, is within the limits.

2. EXPERIMENTAL

We have selected four types of yarns indicated in Table 1. [5]. For each quality have been chosen ten cops from different batches with the idea to have represented a large range of unevenness of the yarn, from very regular batches to faulty batches with some manufacturing faults (tables 2 to 5).

Table 1: Types of yarns

YARN				
PARAMETRES	1	2	3	4
Composition	Acrylic/wool/mohair	Acrylic/polyamide	Wool/acrylic	Wool/acrylic/angora
High Bulk effect	yes	yes	not	yes
Yarn count (Nm)	30	25	40	50
Twist (v/m)	350	350	500	550
Twist direction	Z	Z	Z	Z

In the Keisokki evenness meter equipment we have determined the unevenness of mass, under conventional terms (coefficient of variation of mass to short period, thin, thick and neps) and also the new index of mass deviation DR. For the determination of the DR we have worked with a reference length of 1,5 meters and to a sensitivity of $\pm 5\%$.

After the evenness test, it is suitable to know the law that relates the DR with the test sensitivity. From the evenness graphic we have determined the value of sensitivity in which the DR becomes zero (last column of tables 2 to 5). This parameter is very important for the textile technician.

Table 2: Evenness of mass. Yarn 1 - Acrylic/wool/mohair. High Bulk

CV (%) (1)	THIN (2)	THICK (3)	NEPS (4)	DR (1,37 m \pm 5)	DR= 0
15,64	6	6	34	38,67	18,4
17,18	8	20	88	33,08	16,2
16,41	2	8	8	43,80	24,4
22,54	22	16	24	41,98	Asymptotic
15,99	2	6	34	37,74	17,4
15,84	8	8	26	34,06	18,4
15,82	2	12	20	44,10	21,4
16,21	6	12	46	33,92	23,7
16,65	8	20	52	32,33	20,2
17,19	12	14	56	38,96	Asymptotic
16,95	8	12	39	37,86	----
(1) Coefficient of variation of mass to short period (3) In 1000 meters of yarn, at +50% sensitivity					
(2) In 1000 meters of yarn, at -50% sensitivity (4) In 1000 meters of yarn at +200% sensitivity					

Table 3: Evenness of mass. Yarn 2 - Acrylic/polyamide. High Bulk

CV (%)	THIN	THICK	NEPS	DR (1,37 m \pm 5)	DR= 0
15,04	4	0	42	34,81	17,0
14'62	2	4	22	34,41	15,0
15,16	4	4	22	39,10	16,5
15,69	2	6	20	44,07	18,4
15,26	4	8	64	31,60	17,2
15,30	6	2	22	32,94	14,2
15,12	2	2	28	37,76	15,6
15,27	4	0	50	36,70	15,6
15,87	8	8	6	35,84	14,2
15,37	6	2	8	36,81	14,6
15,27	4	4	28	36,40	15,8

Table 4: Evenness of mass. Yarn 3 - Wool/acrylic

CV (%)	THIN	THICK	NEPS	DR (1,37 m \pm 5)	DR= 0
18,45	72	24	28	40,62	19,2
19,95	144	72	38	42,41	17,9
18,51	76	60	34	39,91	18,0
18,26	56	34	44	37,91	19,8
17,05	30	20	26	39,89	17,4
18,32	60	34	26	39,54	17,6
19,33	106	74	24	39,16	17,4
18,82	62	28	68	37,54	19,0
18,08	66	24	18	33,13	18,6
19,22	100	72	20	40,81	17,2
18,60	77	44	33	39,09	18,2

Table 5: Evenness of mass. Yarn 4 - Wool/acrylic/angora. High Bulk

CV (%)	THIN	THICK	NEPS	DR (1,37 m \pm 5)	DR= 0
17,31	10	30	102	33,60	15,8
15,84	0	10	126	35,71	16,0
17,96	6	14	98	62,85	Asymptotic
15,71	2	8	72	36,24	16,6
15,76	2	14	68	26,18	14,5
16,22	8	28	74	31,46	15,0
15,55	4	4	58	28,82	13,6
16,58	10	12	84	36,98	23,0
16,90	4	6	100	47,50	Asymptotic
15,51	0	12	50	28,23	16,4
16,33	5	14	83	36,76	----

With each one of the tested yarns, we carried out a knitted fabric with the same technical conditions, so that four observers, with a large industrial experience, they would classify them according to its aspect.

In table 6 are indicated the coefficients of correlation of Spearman, between the DR and the order of classification of knitted fabrics.

Table 6: Spearman correlation coefficients (r_s)

YARN TYPE	BETWEEN DR AND CLASIFICACION ORDER OF FABRIC (*)	(*) BETWEEN CV OF MASS AND CLASSIFICATION ORDER OF FABRIC
1	$r_s = 0,903$ Significant to 1%	$r_s = -0,248$ Without correlation
2	$r_s = 0,855$ Significant to 1%	$r_s = 0,018$ Without correlation
3	$r_s = 0,843$ Significant to 1%	$r_s = -0,539$ Without correlation
4	$r_s = 0,891$ Significant to 1%	$r_s = -0,612$ Without correlation
(*) Adjusted of the valuations given by four experts		

3. CONCLUSIONS

- For all the studied yarns we obtain significant correlations to 1%, which indicates that exists a good correlation between the DR and the aspect of knitted fabrics.
- On the contrary, does not exist a good correlation between the coefficient of variation of mass at short period of the yarns and the aspect of knitted fabrics obtained with these yarns.
- Does not exist, either, an intense correlation between thin, thick, neps and the aspect of knitting finished fabrics.
- For the deviation rate DR (%) a limit value of 40% is placed. In all the studied cases, when surpassing this limit we have knitted fabrics with an appearance that is little appraised in the textile trading.
- For fine gauge knitted fabrics it is recommended to have DR values low to 25%, for classified products like of excellent quality.

ACKNOWLEDGEMENTS

We thank to all those companies that have collaborated in the experimental phase and also to the Technical Services of Keisokki Kogyo, Co. Ltd. of Osaka (Japan) for the technical support.

REFERENCES

- [1]. Marsal F., Okuda K., Toneu J.M., Yamasaki S. *Parametría de hilos*. Ed. UPC.
- [2]. Okuda K. Private communication.
- [3]. Yamasaki S. Private communication.
- [4]. Keisokki Kogyo Co., Ltd. (Japan). Private communication.
- [5]. Technological Innovation Centre CTF. Internal documents.